

CLAIMS

WHAT IS CLAIMED IS:

1. A temperature management system for temperature management a thermal component comprising:
 - a heat exchanger in thermal communication with the thermal component;
 - a heat sink; and
 - a thermal conduit system thermally connecting the heat exchanger with the heat sink.
2. The temperature management system of claim 1 where the heat exchanger is a micro-capillary, cold plate heat exchanger.
3. The temperature management system of claim 1 where the thermal conduit system comprises a thermally conductive material.
4. The temperature management system of claim 1 where the thermal conduit system comprises a coolant fluid conduit system for the flow of a coolant fluid.
5. The temperature management system of claim 4 further comprising a fluid transfer device for flowing the coolant fluid through the thermal conduit system.
6. The temperature management system of claim 1 where the temperature management system

and the thermal component are in a tool selected from the group consisting of a downhole drill string tool, a downhole wireline tool, a permanently installed downhole tool, or a temporary well testing tool.

7. The temperature management system of claim 1 where the thermal component is selected from the group consisting of a heat generating component, a heat dissipating component, or a heat sensitive component.

8. The temperature management system of claim 1 where the thermal component is in an environment with a higher temperature than the thermal component.

9. The temperature management system of claim 1 where the thermal component is in an environment with a lower temperature than the thermal component.

10. The temperature management system of claim 1 where the heat sink comprises a phase change material.

11. The temperature management system of claim 10 where the phase change material comprises a eutectic material.

12. The temperature management system of claim 1 where the temperature management system is at least partially contained within a thermal barrier.

13. The temperature management system of claim 12 where the thermal barrier comprises an evacuated container.
14. The temperature management system of claim 13 where the evacuated container is filled with a thermally hindering material.
15. The temperature management system of claim 5 where the fluid transfer device comprises a pump.
16. The temperature management system of claim 15 where the pump is selected from the group consisting of a mini-pump or a micro-pump.
17. The temperature management system of claim 1 comprising more than one heat exchanger and wherein the thermal conduit system comprises more than one thermal conduit branch allowing fluid flow through the heat exchangers.
18. The temperature management system of claim 17 further comprising a valve for controlling fluid flow through the heat exchangers.
19. The temperature management system of claim 17 where the heat exchangers are arranged in the thermal conduit system in parallel.

20. The temperature management system of claim 19 comprising a valve for controlling fluid flow through the heat exchangers.
21. The temperature management system of claim 17 where the heat exchangers are arranged in the thermal conduit system in series.
22. The temperature management system of claim 21 comprising a valve for controlling fluid flow through the heat exchangers.
23. The temperature management system of claim 17 where the heat exchangers are arranged in a combination of series and parallel.
24. The temperature management system of claim 23 comprising a valve for controlling fluid flow through the heat exchangers.
25. The temperature management system of claim 4 where the thermal conduit system is a closed loop system.
26. The temperature management system of claim 4 where the thermal conduit system is an open loop system.

27. The temperature management system of claim 1 where the heat exchanger is in direct thermal contact with the thermal component.

28. The temperature management system of claim 1 where the heat exchanger is in indirect thermal contact with the thermal component.

29. A temperature management system for temperature management a thermal component comprising:

a heat exchanger in thermal communication with the thermal component;

a heat sink; and

a thermal conduit system thermally connecting the heat exchanger with the heat sink, the thermal conduit system comprising a thermally conductive material.

30. The temperature management system of claim 29 where the temperature management system and the thermal component are in a tool selected from the group consisting of a downhole drill string tool, a downhole wireline tool, a permanently installed downhole tool, or a temporary well testing tool.

31. The temperature management system of claim 29 where the thermal component is selected from the group consisting of a heat generating component, a heat dissipating component, or a heat sensitive component.

32. The temperature management system of claim 29 where the thermal component is in an environment with a higher temperature than the thermal component.
33. The temperature management system of claim 29 where the thermal component is in an environment with a lower temperature than the thermal component.
34. The temperature management system of claim 29 where the heat sink comprises a phase change material.
35. The temperature management system of claim 34 where the phase change material comprises a eutectic material.
36. The temperature management system of claim 29 where the temperature management system is at least partially contained within a thermal barrier.
37. The temperature management system of claim 36 where the thermal barrier comprises an evacuated container.
38. The temperature management system of claim 37 where the evacuated container is filled with a thermally hindering material.
39. The temperature management system of claim 29 further comprising more than one heat

exchanger and wherein the thermal conduit system comprises more than one thermal conduit branch.

40. The temperature management system of claim 39 wherein the heat exchangers are arranged in the thermal conduit system in parallel.

41. The temperature management system of claim 39 wherein the heat exchangers are arranged in the thermal conduit system in series.

42. The temperature management system of claim 39 wherein the heat exchangers are arranged in a combination of series and parallel.

43. The temperature management system of claim 29 wherein the heat exchanger is in direct thermal contact with the thermal component.

44. The temperature management system of claim 29 where the heat exchanger is in indirect thermal contact with the thermal component.

45. A temperature management system for temperature management a thermal component comprising:

a micro-capillary, cold plate heat exchanger in thermal communication with the thermal component;

a heat sink;

a thermal conduit system thermally connecting the heat exchanger with the heat sink, the thermal conduit system comprising a coolant fluid conduit system for the flow of a coolant fluid; and

a fluid transfer device for flowing the coolant fluid through the thermal conduit system.

46. The temperature management system of claim 45 where the temperature management system and the thermal component are in a tool selected from the group consisting of a downhole drill string tool, a downhole wireline tool, a permanently installed downhole tool, or a temporary well testing tool.

47. The temperature management system of claim 45 where the thermal component is selected from the group consisting of a heat generating component, a heat dissipating component, or a heat sensitive component.

48. The temperature management system of claim 45 where the thermal component is in an environment with a higher temperature than the thermal component.

49. The temperature management system of claim 45 where the thermal component is in an environment with a lower temperature than the thermal component.

50. The temperature management system of claim 45 where the heat sink comprises a phase change material.

51. The temperature management system of claim 50 where the phase change material comprises a eutectic material.

52. The temperature management system of claim 45 where the temperature management system is at least partially contained within a thermal barrier.

53. The temperature management system of claim 52 where the thermal barrier comprises an evacuated container.

54. The temperature management system of claim 53 where the evacuated container is filled with a thermally hindering material.

55. The temperature management system of claim 45 where the fluid transfer device comprises a pump.

56. The temperature management system of claim 55 where the pump is selected from the group consisting of a mini-pump or a micro-pump.

57. The temperature management system of claim 45 comprising more than one heat exchanger

and wherein the thermal conduit system comprises more than one thermal conduit branch allowing fluid flow through the heat exchangers.

58. The temperature management system of claim 57 further comprising a valve for controlling fluid flow through the heat exchangers.

59. The temperature management system of claim 57 where the heat exchangers are arranged in the thermal conduit system in parallel.

60. The temperature management system of claim 59 comprising a valve for controlling fluid flow through the heat exchangers.

61. The temperature management system of claim 57 where the heat exchangers are arranged in the thermal conduit system in series.

62. The temperature management system of claim 61 comprising a valve for controlling fluid flow through the heat exchangers.

63. The temperature management system of claim 57 where the heat exchangers are arranged in a combination of series and parallel.

64. The temperature management system of claim 63 comprising a valve for controlling fluid

flow through the heat exchangers.

65. The temperature management system of claim 45 where the thermal conduit system is a closed loop system.

66. The temperature management system of claim 45 where the thermal conduit system is an open loop system.

67. The temperature management system of claim 45 where the heat exchanger is in direct thermal contact with the thermal component.

68. The temperature management system of claim 45 where the heat exchanger is in indirect thermal contact with the thermal component.

69. A method of absorbing heat from a thermal component comprising:

absorbing heat from the thermal component with a heat exchanger in thermal contact with thermal component;

absorbing heat from the heat exchanger with a heat sink in thermal communication with the heat exchanger.

70. The method of claim 69 further comprising:

flowing coolant fluid through a thermal conduit system thermally connecting at

the heat exchanger to the heat sink using a fluid transfer device;

absorbing heat from the heat exchanger with the coolant fluid as the coolant fluid flows through the heat exchanger; and

absorbing heat from the coolant fluid with the heat sink as the coolant fluid flows through the heat sink.

71. The method of claim 69 where the heat sink comprises a phase change material.
72. The method of claim 71 where the phase change material is a eutectic material.
73. The method of claim 69 where the heat exchanger is a micro-capillary, cold plate heat exchanger.
74. The method of claim 69 where the thermal component is in a tool selected from the group consisting of a downhole drill string tool, a downhole wireline tool, a permanently installed downhole tool, or a temporary well testing tool.
75. The method of claim 69 where the thermal component is selected from the group consisting of a heat generating component, a heat dissipating component, or a heat sensitive component.
76. The method of claim 69 where the thermal component is in an environment with a higher temperature than the thermal component.

77. The method of claim 69 where the thermal component is in an environment with a lower temperature than the thermal component.

78. A method of absorbing heat from a thermal component comprising:

absorbing heat from the thermal component with a heat exchanger in thermal contact with the thermal component;

flowing coolant fluid through a closed loop thermal conduit system thermally connecting the heat exchanger with a heat sink using a fluid transfer device;

absorbing heat from the heat exchanger with the coolant fluid as the coolant fluid flows through the heat exchanger; and

absorbing heat from the coolant fluid with the heat sink as the coolant fluid flows through the heat sink.

79. The method of claim 78 where the heat sink comprises a phase change material.

80. The method of claim 78 where the phase change material is a eutectic material.

81. The method of claim 78 where the heat exchanger is a micro-capillary, cold plate heat exchanger.

82. The method of claim 78 where the thermal component is in a tool selected from the group

consisting of a downhole drill string tool, a downhole wireline tool, a permanently installed downhole tool, or a temporary well testing tool.

83. The method of claim 78 where the thermal component is selected from the group consisting of a heat generating component, a heat dissipating component, or a heat sensitive component.

84. The method of claim 78 where the thermal component is in an environment with a higher temperature than the thermal component.

85. The method of claim 78 where the thermal component is in an environment with a lower temperature than the thermal component.